Using Pavement Management Software to Optimize Your Pavement Preservation Program –
The Montgomery County

Introduction by:

Randy Paugh, Pavement Management Engineer,
Montgomery County Division of Highway Services

Presented by:

Alan Kercher P.E., President, Kercher Engineering, Inc.
Topics to be Covered

- Overview of Comprehensive Pavement Management
- What Functionality Should a County’s PMS Software Have?
  - Montgomery County Story
Comprehensive Pavement Management

- More than just Software
- Cradle to Grave Approach
  - Project-specific Designs
    - Utilizing the Toolbox
  - Project-specific Contract Documents
  - Thorough Inspection
- Land Development
  - Ensuring Durability of New Infrastructure
- Utilities
Utilize the Entire Tool Box
Should Have Been CIR
Should Have Been FDR
Design and Build it Correctly

4 Projects - All <6-Months Old
Destroyed by Utility Cuts
Utility Cuts - Planned Destruction
Pavement Management Software to Optimize Your Pavement Preservation Program

The Montgomery County Story
Montgomery County Pavement Management System

- 24,000 Segments
- Management Setup
  - Compatible to County Practices
- Created Street Inventory File
  - Data Compatible with County’s GIS Data
- Initial Road Rating Data Completed
  - June 2008 to August 2008
Goals

- Network Level Planning Tool
  - Predicting the Future
  - Rigorous Budget Analysis
- Project Level Tools
  - Historical Database
  - Design Tool
- Automating Project List Process
  - Neighborhoods
- Integration with other Departments/Agencies
Pavement Management Software

- Budget Analysis Tool
- Project Level Design Tool
- Research Tool
Network Level

- Budget Analysis - What if scenarios
  - Status Quo
  - Increase Budget
  - Decrease Budget
- Repair Strategies
  - Optimized vs. Worst First
  - CIR vs. Remove and Replace
- Goal Setting
Configuration

- Unique Pavement Types
  - Thick Pavements vs. Thin Pavements
  - High Traffic vs. Low Traffic
  - GABC Base vs. Recycled Base
  - Hot Mix w/ Micro-Surfacing vs. No Micro-surfacing

- Different Treatments by Classification, etc.
  - Multiple Decision Trees

- Unique Performance Models
Integration with Asset Management:

- Sidewalks
  - ADA, Walkable Communities, Safe Routes to School, etc.
- Safety Improvements
  - Realignments, Intersections, Friction, etc.
- Drainage/Utilities
  - Cut Policies, Coordinate Activities, etc.
- WSSC
Montgomery County Pavement Management System

- Implementation Started - May 2009
  - Management Setup
  - Optimization Analyses, Multi-year Funding Reports and Backlog (Benefit) Reports
- Completed August 2009
Backlog Analysis
aka “Monetary Impact” of Deterioration

Benefits of Optimization
“Sustainability”
Worst-First vs. Optimized $10 Mil./Yr.

Network Condition - $10 Million Per Year Budget - Optimized vs. Worst First
<table>
<thead>
<tr>
<th>Funding Level</th>
<th>Worst-First</th>
<th>Optimized</th>
<th>Decrease in Backlog</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000,000</td>
<td>$680 Mil.</td>
<td>$550 Mil</td>
<td>$130 Mil.</td>
</tr>
<tr>
<td></td>
<td>PCI = 37</td>
<td>PCI = 48</td>
<td></td>
</tr>
<tr>
<td>$15,000,000</td>
<td>$630 Mil.</td>
<td>$470 Mil</td>
<td>$160 Mil.</td>
</tr>
<tr>
<td></td>
<td>PCI = 40</td>
<td>PCI = 54</td>
<td></td>
</tr>
<tr>
<td>$20,000,000</td>
<td>$570 Mil.</td>
<td>$370 Mil</td>
<td>$200 Mil.</td>
</tr>
<tr>
<td></td>
<td>PCI = 44</td>
<td>PCI = 59</td>
<td></td>
</tr>
</tbody>
</table>
Condition Threshold PCI=70, Recon <10%
Condition Threshold PCI=70, Recon <10%
### AgileAssets

**Multi-Constraint Examples**

Scenario No. 41 – PCI Threshold Varies to 70, Reconstruction Varies to 10%, Limiting Funds

<table>
<thead>
<tr>
<th>Year</th>
<th>Option 1</th>
<th></th>
<th></th>
<th>Option 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum % Reconstruction</td>
<td>Minimum PCI</td>
<td></td>
<td>Maximum % Reconstruction</td>
<td>Minimum PCI</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>45</td>
<td>56</td>
<td></td>
<td>50</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>58</td>
<td></td>
<td>49</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>60</td>
<td></td>
<td>48</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>35</td>
<td>62</td>
<td></td>
<td>47</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>64</td>
<td></td>
<td>46</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>66</td>
<td></td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>68</td>
<td></td>
<td>44</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>70</td>
<td></td>
<td>43</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>70</td>
<td></td>
<td>42</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>70</td>
<td></td>
<td>40</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
Multi-Constraint Analysis
Goal Setting
Condition Threshold PCI=70, Recon <10%, By Repair Category
Backlog Analysis

Comparison of Different Repair Alternatives

CIR vs. Tradition Recon
Cold In-place Recycling vs. Traditional Reconstruction
$8 Million Per Year
Cold In-place Recycling vs. Traditional Reconstruction
$8 Million Per Year

2011 Backlog
- Conv Recon = $223 million
- CIPR = $156 million
  $ 67 million

2016 Backlog
- Conv Recon = $429 million
- CIPR = $243 million
  $186 million
Project Level Tools
Micro-Surfacing Project

- In 1995 – Pavement Management Analysis
  - Thin HMA w/ Little Base
  - Most Streets – M/H Severity Fatigue Cracking
    - Selected Repair – FDR w/ Cement

- Town-wide Waterline to be installed in 3 Years
  - Decided to Seal, Patch & Micro
2008

13-year old Sacrificial Layer
3 in. Binder/Micro on Gravel Road

Some Structural Cracking
No Environmental Cracking
Cold In-place Recycling

- Main road through an Industrial Park
  - Trash Transfer Station
    - More than 200 Trash Trucks/day - 6 days a week
    - 20 Trailers per day - 6 days a week
  - Concrete Plant
  - Crane Rental Business
  - Several Manufacturers
  - Many Warehouses
Cold In-place Recycling

- Pavement Cross-Section
  - 6 to 16 inches of Asphalt/Aggregate
  - "Evolutionary" Road (widened twice)

- Pavement Condition
  - Severe structural failure
  - Severe Cross-Slope and Profile Problems

- In 1994 - 5 inch CIR Base & 2 inch Overlay
**Historical Data**

- **Work Histories**
  - Track all Work Done to a Segment
  - Contract Based
  - Historical Repository – Attach Documents, Photos, etc.
  - Very Helpful for:
    - Design of Repairs
    - Development/Update of Performance Models

- **Pavement Layer Information**
  - Automatically Built by Entering Work Histories

- **Condition Histories**
Project Level

- **Work Histories**
  - Track all Work Done to a Segment
  - Contract Based
  - Historical Repository – Attach Documents, Photos, etc.
  - Very Helpful for:
    - Design of Repairs
    - Development/Update of Performance Models

- **Pavement Layer Information**

- **Condition Histories**
Research Tool

- Reviewing Performance data
  - What works vs. What doesn’t
- Fine tuning decision models
  - Creating more classifications
    - thick vs. thin
    - w/ micro & w/o micro
    - w/ GABC vs. FDR vs. CIR
  - good vs. poor drainage
Work Histories
Work Histories
Pavement Layer Info
### Work Histories

#### Attachments

<table>
<thead>
<tr>
<th>District Name</th>
<th>Project Location</th>
<th>Contractor</th>
<th>Typical Section</th>
<th>Year of Completion</th>
<th>Treatment</th>
<th>Work Code</th>
<th>Att.</th>
<th>Comments</th>
<th>Last Updated by</th>
<th>Last Updated on</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-01</td>
<td>Jones Bridge Rd-07-29</td>
<td>ABC Contractors</td>
<td></td>
<td>1995</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996-01</td>
<td>Jones Bridge Rd-01-06</td>
<td>Acme Construction</td>
<td></td>
<td>1996</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-01</td>
<td>Jones Bridge Rd-10</td>
<td>ABC Contractors</td>
<td></td>
<td>2001</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-01</td>
<td>Jones Bridge Rd-01-02</td>
<td>ABC Contractors</td>
<td></td>
<td>2002</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-01</td>
<td>Jones Bridge Rd-03-05</td>
<td>ABC Contractors</td>
<td></td>
<td>2003</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004-01</td>
<td>Jones Bridge Rd-10</td>
<td>ABC Contractors</td>
<td></td>
<td>2004</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005-01</td>
<td>Jones Bridge Rd-10-02</td>
<td>ABC Contractors</td>
<td></td>
<td>2005</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006-01</td>
<td>Jones Bridge Rd-03-22</td>
<td>ABC Contractors</td>
<td></td>
<td>2006</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007-01</td>
<td>Jones Bridge Rd-10</td>
<td>ABC Contractors</td>
<td></td>
<td>2007</td>
<td></td>
<td>Construction</td>
<td>AARON</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Material Codes**

- **Material Code**: AARON
- **Color**: New Material
- **Surface**: AC Surface
- **Texture**: CSA-1342
- **Layer Category**: AC Surface 4G

---

**Image Description:**

The image shows a screenshot of a software interface for managing work histories and attachments. The interface includes a grid with various columns such as District Name, Project Location, Contractor, Typical Section, Year of Completion, Treatment, Work Code, Att., Comments, Last Updated by, and Last Updated on. A red arrow points to a section of the interface, indicating a focus on specific data entries or functionalities. The software interface appears to be part of the AgileAssets Management System V 5.0 (build 3401).
### Work Histories

**Attachments**

```plaintext
<table>
<thead>
<tr>
<th>District Name</th>
<th>Project Location</th>
<th>Contractor</th>
<th>Typical Section</th>
<th>Year Completion</th>
<th>Treatment</th>
<th>Work Code</th>
<th>Att.</th>
<th>Comments</th>
<th>Last Updated by</th>
<th>Last Updated on</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-01</td>
<td>Jones Bridge Rd-07-29</td>
<td>ABC Contractors</td>
<td></td>
<td></td>
<td>Reconstruction</td>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Jones Bridge Rd-01-06</td>
<td>Acme Construction</td>
<td></td>
<td></td>
<td>Reconstruction</td>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-01</td>
<td>Work With Attachments</td>
<td>open_comments</td>
<td></td>
<td></td>
<td>Rehabilitation</td>
<td>Rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation</td>
<td>Rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation</td>
<td>Rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004-04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation</td>
<td>Rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**Material Codes**

<table>
<thead>
<tr>
<th>Layer</th>
<th>Material Code</th>
<th>Thickness</th>
<th>Comments</th>
<th>Att.</th>
<th>Last Upd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WC1</td>
<td>10</td>
<td></td>
<td></td>
<td>AARON</td>
</tr>
<tr>
<td></td>
<td>BC1</td>
<td>2</td>
<td></td>
<td></td>
<td>AARON</td>
</tr>
<tr>
<td></td>
<td>BCBC-1</td>
<td>7</td>
<td></td>
<td></td>
<td>AARON</td>
</tr>
<tr>
<td></td>
<td>GABC-1</td>
<td>4</td>
<td></td>
<td></td>
<td>AARON</td>
</tr>
</tbody>
</table>
```

**Asphalt**

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Color</th>
<th>SI Coef.</th>
<th>Layer Category</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISA/Gruavel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binder/Gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.38 Surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Change order... Add...
Work Histories
Attachments

PG-64-22 - PATCHING

401644 - SUPERPAVE, TYPE C HOT-MIX, 140 GERATIONS, PG-64-22, WEDGE
401649 - SUPERPAVE, TYPE B HOT-MIX, 140 GERATIONS, PG-64-22, WEDGE

Description:

The following Subsections of the Standard Specifications shall be applicable: 401.01, 401.03 - 401.10, and 401.13. All other subsections have been modified herein.

The Contractor shall read and thoroughly understand the requirements of the QA/QC specifications as defined in item 401.09. It is the responsibility of the Contractor to determine all costs associated with meeting these requirements and to include them in the per ton bids for the

SPECIAL PROVISION

401.08.2 Hot-Mix asphalt concrete - The Contractor shall also be aware that the pay adjustment factors in item 401.09 will be applied to the Superpave hot-mix concrete payments to determine the bonus or penalty for the item.

Materials:

The Superpave hot-mix asphalt concrete shall conform to the requirements of Specifications 803, 809, 812, 813, 815, 816, 819, 820, 827, and 833 of the Standard Specifications and the specifications and requirements contained in this item.
Questions?